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Elite football players' perceptions of football turf and natural grass surface properties

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Abstract

Given the global spread of football (soccer) there are substantial differences in the playing surfaces used between FIFA member associations. This paper contains results from the second part of a study on elite football players' perceptions of playing surfaces from across the globe. Using a questionnaire, which was developed based on an initial qualitative study, elite players' perceptions of differences in surface properties between natural and artificial (football) turf were examined. In total, 1129 elite footballers, representing 43 countries across six FIFA confederations completed the questionnaire. Exploratory analysis of overall responses revealed that the players had strong opinions with regards to surface properties when directly comparing natural and football turf. In particular, a higher proportion of players stated that football turf was *"Too hard/Harder"*, *"More level"*, *"More abrasive"* and had *"Less grip"* compared to natural grass. The results also showed that overall players' perceptions of surface properties, between natural grass and football turf were dependent on their experience of different playing surfaces during their junior and senior careers, in particular, the variability within football turf pitches.

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Keywords: football playing surfaces; elite players; questionnaire; quantitative; surface properties

1. Introduction

Football is a global sport with 112,000 registered elite players worldwide (FIFA, 2006). Each elite player is associated to one of the Fédération Internationale de Football Association (FIFA) member associations which

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represent football across the globe. Given the global spread of members associations, there are substantial differences in the playing surfaces between associations, due in part, to factors such as the climate.

The different playing surfaces include natural grass, reinforced natural grass, artificial turf and hard surfaces (e.g. clay, sand, gravel and wood).Consequently, in 2004-2005 FIFA modified the laws of the game allow the use of artificial turf (herein termed football turf in accordance with FIFA terminology), as an alternative to natural grass if preferred, for competitive matches between FIFA member associations. Many studies have compared the technical and physical aspects of a player's performance between natural and football turf which include ball-surface interactions (Mooney & Baker, 2000), player-surface interactions (Müller et al., 2010) risk of injury (Steffen, Andersen, & Bahr, 2007), and style of play (Andersson, Ekblom, & Krustrup, 2008). However, an area that is often neglected from surface type comparison studies are players' perceptions of playing surfaces and therefore it is unknown which aspects of the playing surface are important for players.

A recent qualitative study of elite players' perceptions of playing surfaces revealed a number of key themes regarded as important to players when comparing playing surfaces (Ronkainen et al., 2011). The qualitative study was only conducted using players from European countries; therefore, it was deemed necessary to quantitatively explore the key themes across from a wider population to determine global variations in opinions (Ronkainen et al., 2011). This paper presents the results from a questionnaire that was developed to gather this data. One important theme addressed in the questionnaire was the perception of surface properties between natural and football turf and this will be the focus of the paper.

The purpose of this study therefore was to quantify elite players' perceptions of playing surfaces across the globe and three objectives were proposed. The first objective was to determine elite players' perceptions of surface properties between natural and football turf in different regions of the world. The second objective was to determine the surface experience of elite players' included in the questionnaire. The third objective was to discover predictors that could explain elite players' perceptions of surface properties between natural and football turf. The results of this study could be useful to those who develop, install and maintain playing surfaces.

2. Methods

A questionnaire was developed and implemented to capture the world's elite players' perceptions of the key themes that emerged from a qualitative study of playing surfaces used in football (Ronkainen et al., 2011).

2.1. Sample Size and Participant Selection

In 2006 it was reported that there were 112,000 registered elite players representing six FIFA confederations (53% in UEFA (Europe); 22% in CONMEBOL (South America); 10% in AFC (Asia); 8% in CONCACAF (North & Central America); 6% in CAF (Africa) and 0% in OFC (Oceania)) (FIFA, 2006). A target sample size was determined for each confederation to result in a confidence interval of 5 – 7% and reflect the distribution of players amongst confederations. Due to time restraints, a sample of countries from each confederation were selected based on pre-defined criteria such as the number of elite players in the country, geographical location and number of FIFA approved football turfs.

2.2. Data Collection – Questionnaire Design

All players gave their informed consent and the study was approved by Loughborough University Ethical Advisory committee. When possible, a representative from the Sports Technology Institute at Loughborough University was present whilst players completed the questionnaire. Furthermore, the questionnaire underwent formal pilot testing to ensure the data collected would be valid, reliable and acceptable.

The questionnaire had three sections. The first section gathered socio-demographic information. The second section gathered information on each player's experience playing on different surfaces. This involved a series of behavioral questions regarding their experience as both junior (i.e. under 18 years old) and senior players of training and playing matches on four different surface types: natural grass (defined as a surface formed by preparation of an area of grass land), football turf (defined as a surface constructed of manufactured material),

gravel/hard surface (defined as a surface with a course covering of gravel or concrete) and indoor (defined as a hard indoor surface). The players were asked how often they played on each of the four surface types, with five response category choices, *"Always", "Usually", "Sometimes", "Rarely"* or *"Never"*. The third section addressed the key themes that were prevalent when discussing characteristics of playing surfaces with elite players during the initial qualitative study. This section included questions which asked players to directly compare football turf and natural grass pitches with respect to eight pitch properties (hardness, bumpiness, surface pace, consistency, abrasiveness, grip, grass length and grass thickness). The players were asked to complete the statement *"Football turf pitches are…compared to natural grass pitches"* by choosing a response from a five-point category scale with respect to each of the pitch properties. For example, the responses for pitch hardness were *"Too hard", "Harder", "No different", "Softer"* and *"Too soft"*. In addition, for each pitch property, players were asked to rate the variation in that property across different natural grass pitches they have played on and also for different football turf pitches they have played on using the four-point category scale, *"Not at all", "A little", "A lot"* and *"Too much"*.

2.3. Statistical Methods

Questionnaire data was cleaned to ensure meaningful conclusions could be drawn. For example, the players' height, weight and date of birth were checked for anomalous entries. Initially, the global players' perceptions were considered as a whole followed by more in-depth interrogation of variations in the data. The questionnaire data was analysed using the statistical analysis software R (R Foundation For Statistical Computing, Austria). An initial exploratory analysis of the overall responses to the statements regarding pitch properties was performed, followed by further interrogation of the responses on sub-groups of the data, such as the country a player was playing their club football in at the time of completing the questionnaire.

The main analysis addressed whether players' comparisons of the differences between football turf and natural grass pitches, with respect to eight pitch properties, were related to factors (predictor variables) such as their previous surface experience, their age, and their perceptions of the variability in pitch properties across different natural grass and football turf pitches they have played on. To facilitate this analysis, ordinal logistic regression models were used to model players' responses to each of the eight statements comparing football turf and natural grass pitches, with the other factors treated as predictor variables in the models. Hence eight ordinal logistic regression models were fitted with the responses, one model for each of the eight statements comparing football turf and natural grass pitches. A more detailed description of the approach used for this type of ordinal logistic regression model can be found in Owen et al. (2013).

To derive suitable measures of players' surface experience, a principal component analysis (PCA) was also performed on players' surface experience as described by Owen et al. (2013). This PCA facilitated four measures of players' surface experience. To facilitate the inclusion of players' perceptions of the variability in pitch properties within natural grass pitches in the model, their responses on the four-point category scale, *"Not at all", "A little", "A lot"* and *"Too much"*, were scored as 1, 2, 3 and 4 respectively, and then these scores summed across the eight pitch properties to obtain a total score for each player. This scoring mechanism was also used for players' responses to the variability in pitch properties across football turf pitches. Again, further details of the development of these scores are provided in Owen et al. (2013). Finally, the ratio of players' natural grass variability score divided by their football turf variability score was used as a measure of the relative variability.

3. Results

3.1. Descriptive Data

A total of 1129 elite players (1018 male and 111 female) representing 43 countries across the six FIFA confederations completed the questionnaire. The players' ages ranged from 18 to 39 years old.

3.2. Playing Surface Properties

The overall players' responses to the statements regarding surface properties between natural and football turf are summarised in Figure 1. Over 80% of the players regarded football turf as *"Too hard/Harder"* than natural grass. Over 60% regarded football turf to be *"Too fast/Faster"*, *"Too abrasive/More abrasive"* and *"Too little grip/Less grip"* than natural grass. Further exploration of the sample data revealed apparent differences between countries. An example of the responses regarding surface hardness by country is presented in Figure 1b. A high proportion of Mexico players' in the sample (n = 46) stated football turf was too hard compared to players' from Jamaica (n = 53) or the Democratic Republic of Congo (n = 41).

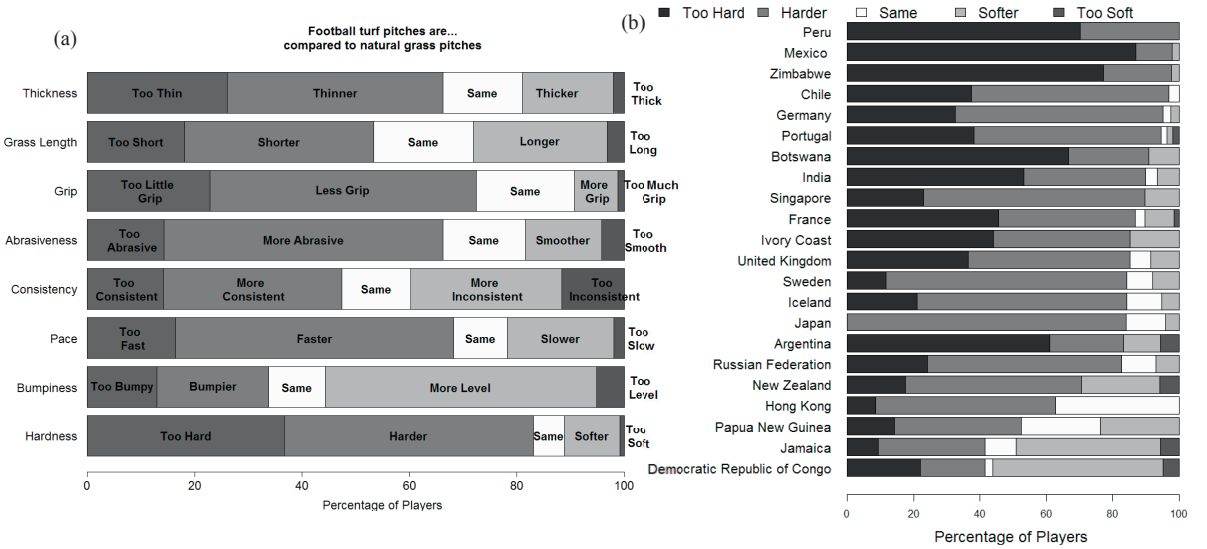

Fig. 1.(a) Overall responses of players regarding surface properties between natural grass and football turf and (b) Players responses regarding surface hardness between natural grass and football turf by country.

3.3. Surface Experience and Ordinal Logistic Regression Model

Scatterplots of the mean scores of the four principal components for each country with more than 20 questionnaire respondents are presented in Figure 2. The PCA revealed four principal components which explained the players' surface experience. Principal component one (PC1) explained the largest variation between players' surface experience and was a measure of their overall experience on natural grass, such that, larger positive PC1 scores were associated with players who had more experience on natural grass and less experience on other surfaces (in this case football turf or gravel) and vice versa for lower PC1 scores. For example, the largest positive PC1 score was for Mexico suggesting those players had the most experience on natural grass, whereas the Democratic Republic of Congo had the largest negative PC1 score and hence the least experience on natural grass (Fig. 1). PC2 explained the contrast between players with more gravel experience versus those with more football turf experience as both juniors and seniors. Large positive PC2 scores represented players who had more experience on gravel and less experience on football turf (e.g. Botswana) and vice versa for negative scores. PC3 explained the extent to which players' surface experience changed between natural and football turf from junior to senior level. Larger positive PC3 scores were associated with players who had more natural grass experience as juniors but had more football turf experience as seniors (e.g. Ivory Coast). Finally, PC4 represented a measure of the extent to which players' surface experience changed between training and playing as seniors. Larger positive PC4 scores were associated with players, who as seniors, trained more on natural grass but played matches more on football turf (e.g. Ivory Coast).

The odds ratios for each standardized predictor variable in the ordinal logistic regression models are summarized in Table 1.

Odds ratios greater than one signify an increased likelihood that players would respond with a higher category of response (i.e. categories moving from left to right in Figure 1a).

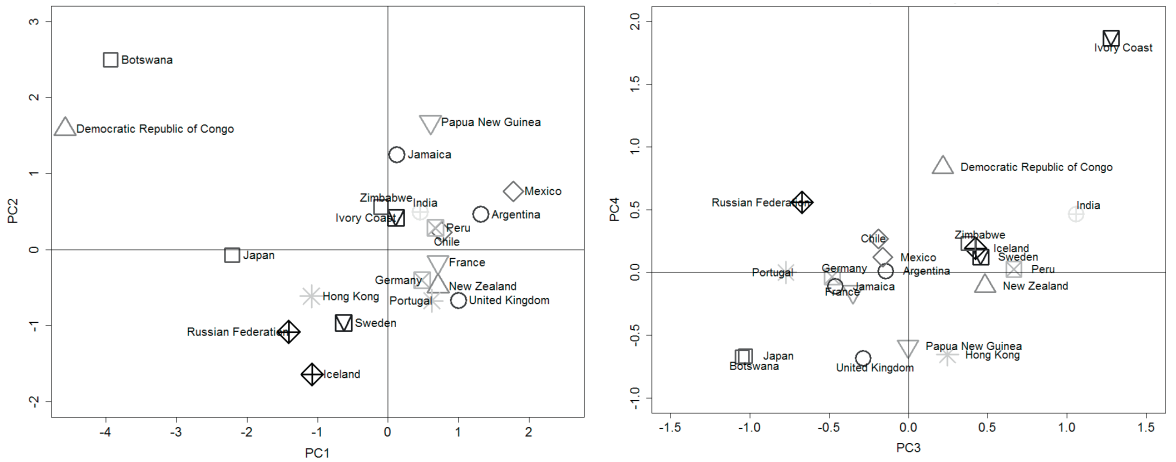

Fig. 2. Mean principal component scores representing the surface experience of players in each country that participated in the questionnaire (only includes countries with > 20 respondents).

For example, an odds ratio of 0.74 for the predictor PC1when modeling players' comparisons of hardness, suggests that players with more natural grass experience were more likely to perceive that football turf was harder than natural grass. Similarly, players that have experienced greater variability within football turf pitches were also more likely to perceive that football turf was harder than natural grass. In contrast, players who stated that natural grass pitches were more variable were less likely to state that football turf pitches were harder.

Table 1. Odds ratios for several model predictors and eight surface properties (NG) = Natural grass and (FT) = Football turf.

Model	Dependent Variables							
Predictor	Hardness	Bumpiness	Pace	Consistency	Abrasiveness	Grip	Grass Length	Grass Thickness
PC1	0.74^{***}	0.87^{*}	-	-	-	-	-	0.78^{***}
PC2	-	-	-	0.86^{**}	-	-	0.84^{**}	1.13^{*}
PC3	-	-	0.80^{***}	0.85^{**}	-	-	0.89^{*}	-
PC4	-	-	-	-	0.87^{*}	1.32^{***}	0.81^{***}	-
Age	0.81^{***}	-	0.85^{**}	1.13^{*}	-	-	-	0.84^{**}
NG variability	1.48^{***}	1.48^{***}	1.38^{**}	-	-	-	-	1.80^{***}
FT variability	0.39^{***}	0.52^{***}	0.56^{**}	1.04^{***}	0.79^{**}	1.07^{***}	-	0.37^{***}
Ratio	0.56^{***}	-	0.62^{**}	-	0.71^{***}	-	-	0.47^{***}

*0.01<p < 0.05, **0.001< p < 0.01 & *** p < 0.001

4. Discussion

Overall responses revealed that players' perceived football turf to be harder, faster, more abrasive, have less grip and thinner grass compared to natural grass. However, it is unknown whether these responses were regarded as favorable or unfavorable traits of football turf which would require analysis of additional responses, beyond the scope of this paper. There were apparent differences in the sample of players' responses between countries. Peru (CONMEBOL) was the only country where all players stated football turf was *"Too Hard"* or *"Harder"* than natural grass. Similarly, Chile and Argentina (CONMEBOL), considered football turf to be harder than natural grass. It might be assumed that the player's opinions are similar due to them belonging to the same confederation; however, when examining Figure 1b, Mexico and Jamaica have different opinions regarding the hardness of

football turf despite both countries belonging to the same FIFA confederation (i.e. CONCACAF). Therefore, comparisons between confederations may result in more detailed differences being masked. The differences between countries could be due to a plethora of underlying factors, such as the players' surface experience, wealth of a country, quality of pitches, age of the players or climate, as examples.

The ordinal logistic regression model contained a selection of these predictors. Natural grass surface experience (i.e. PC1) was a significant predictor for players' responses regarding surface hardness. Hence, the differences between Mexico (PC1 = 1.78) and Jamaica (PC1 = 0.12) players' surface experience could explain their varied response to surface hardness. As another example, Peru had more experience playing on football turf when seniors as opposed to juniors (i.e. high PC3) compared to Chile and Argentina (PC3 = -0.15) and so exposure to football turf later in a playing career could explain the increased likelihood that players would regard football turf as faster and more consistent. Age was also a significant predictor for these two surface properties, with older players more likely to perceive football turf as faster but more inconsistent, hence the experience of older players is also important.

The variability within football turf pitches that the players in this sample had experienced was a significant predictor for seven of the eight pitch properties. In particular, players that had experienced greater variability within football turf pitches were more likely to perceive football turf as harder and have thicker grass than natural turf. This result could be an indication of the quality of the football turf that these players had experienced during their playing career.

The small percentage explained by the significant predictors suggests that further predictors should be considered in subsequent logistic regression models to produce a more robust model fit. For example, the model did not include a measure of the quality of the surfaces in the different countries which could influence overall playing performance of the surface in terms of ball behaviour or a player's movements and may impact a player's perceptions of that surface. Therefore, further work would need to account for random effects and surface quality within the logistic model which is an area of ongoing research.

5. Conclusion

Analysis of overall elite players' perceptions of surface properties between natural and football turf revealed noticeable differences, in particular with regard to perceptions of surface hardness, pace, abrasiveness, grip and thickness of grass. It was shown that differences in perceptions observed between countries may not be solely due to demographic differences but rather due to the players' surface experience, perceived variability of surface properties within/between surfaces and to a lesser extent age. Nevertheless, further work is required to include additional predictors and to account for random effects with the regression model.

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